confirmed, we must recognize that the discovery of Franz Joseph's Land was but a first step towards the discovery of the Arctic archipelagoes which undoubtedly exist under and within the 80th degree of latitude. P. A. K.

EARTHQUAKES IN THE LEVANT.[1]

THE Island of Zante, in the Ionian Group, to the north-west of the Gulf of Arcadia, is a centre from which no fewer than seven submarine cables radiate, and Mr. Forster has taken advantage of his position as manager of the station to make some interesting observations of the connection between interruptions of the cables and the occurrence of earthquakes, which are more frequent, he says, in the Levant than in any other part of the world, except Japan. The notes of what he has himself observed are valuable and suggestive, but unfortunately he has made them a peg on which to hang a theory that the "true and only reason for seismic disturbances" is that landslips and subsidences occur in ocean beds. Soundings of the bed of the Mediterranean, made chiefly in the interest of cable-laying, have brought to light extraordinarily rapid variations of depth. In one case, Mr. Forster tells us, the repairing ship of his company found a difference of 1500 feet between the bow and stern soundings. "We know of mushroom-shaped mountain ranges, abrupt and precipitous table-lands, immense marginal shelves and overhanging cliffs. . . . We know by soundings that many of these tottering masses are hanging over precipices from 3000 to 5000 feet in height, and that the erosion of the water at the base of the inverted cone-shaped rocks eventually causes them to slide over." Mr. Forster admits that a secondary cause of earthquakes may be "explosions owing to the filtration of water through the crevices and chasms that a denudation of so large an extent must necessarily cause." He has done good service in drawing attention to a cause of earthquakes which seismologists may have been disposed to under-rate, but he overstates his case outrageously in making this explanation cover every example. "I am prepared, of course," he says, "to encounter a torrent of objections to the acceptation of my theory as the sole cause of seismic disturbances" (*sic*), and this is well.

By way of supporting the theory he has written a long, rambling, inconsequent pamphlet, the manner and matter of which we may illustrate by quoting a paragraph that is neither better nor worse than its neighbours :—

"If, therefore, we are to believe that the process of cooling our planet, which began so many thousands of centuries ago, is gradually and surely condensing the nucleus of liquid or solid fire in its centre, it is reasonable to assume that the bed of the Mediterranean, by virtue of its more recent formation, should be more subject to the effects of the contraction of the upper crust than other parts which have gone through these periods already; because it is evident that the contraction which originally commenced began equally so over the whole surface of the earth's sub-crust, and was, through some unknown reason, abruptly suspended in certain parts which only subsided and very suddenly when the cooling action was once more renewed."

Or this, which the author himself puts in italics :—

". . . *The severity of the concussion is always precisely proportionate to the bulk of the falling mass, the depth of its fall, and the nature of the matter constituting it, and on to which it falls. . . .*"

We commend the following to the attention of electricians, as coming from one of their own number :—

"By 'freeing' a cable, it is understood that the end opposite to the testing-station is detached from the apparatus and left free in the air; and, provided the cable be electrically perfect, no deflection of the magnetic needle will appear at the testing-office when the cable is joined up through a delicate galvanometer to 'earth.' If, however, the cable thus insulated is lying near to or in the direct radius of a volcano, or near to any hot springs, the increased temperature would cause a thermopile to be set up, and by induction through the insulating material its presence would be plainly manifest."

The fact that in certain earthquakes the author made this test and found no current, is used as an argument to show the "absolutely local nature" of what in another place he calls the "*centri*" of the shocks.

What is of real value are his positive observations of certain cases where the rupture of a cable or the production of a bad fault in it took place at the moment an earthquake occurred, and of cases where, when the cable came to be repaired, the contour of the ocean bed was found to have undergone a distinct change, the cable being, in more than one instance, actually buried below the new surface. The great earthquake which destroyed Filiatra in August 1886, shook the telegraph office at Zante so sharply that the clerk rushed out. On returning to his Morse instrument, he found, by the paper band which was still running, that a message coming from Candia had been interrupted at the time of the shock, and tests taken immediately after showed a dead break 23 miles from Zante. Other cables, following a more northerly course, were not disturbed. In another instance a cable was broken at once in two places, 2 miles apart, apparently by a subsidence of the ground between. Once, when the Zante-Trepito cable was broken by an earthquake 7 miles from Zante, the repairing ship discovered "that the break had occurred in a depth of about 2000 feet of water, where about 1400 feet originally existed, and it was impossible to haul in the broken end, firmly jammed down by the mass which had fallen over and upon it."

If Mr. Forster had contented himself with telling the story of facts like these, which have come within his own observation, the seismologist would have felt nothing but gratitude. But these grains of wheat are only reached after wading through an intolerable deal of wordy chaff. The gist of the pamphlet is to be found in the last fifteen or twenty pages, and we advise the reader who wishes to save his patience to go to them at once. We conclude by quoting an interesting passage where Mr. Forster describes two natural phenomena of Cephalonia, about which one would like to know more :—

"Not far from Lizuri, which is on the western side of the Bay of Argostoli, is a moving rock which, unchanged by the roughest or the calmest sea, rocks to and fro with the regularity of a pendulum. It is separated from a fixed mass of rock against which it opens and shuts in its perpetual motion; at one time it will jam a knife placed in the crevice, from which, in a few seconds, extraction is impossible, whilst the next moment you can easily insert your bent hand when its maximum aperture has been reached. This phenomenon has been carefully examined by many scientific men; divers have been sent below to ascertain if it be the result of a detached rock from a neighbouring cliff having fallen on to another, and thus becoming very finely balanced, as all logan stones usually are. However, it was not only shown to be a perfectly solid rock, but it does not require the motion of the water to sway it, as so often we find it erroneously stated, the motive power for swaying it being furnished from an absolutely inexplicable cause. Nearly opposite to this rocking stone the other remarkable phenomenon is to be found, consisting of a body of water, equal in bulk to about half a million gallons per day, running in from the sea at four points on the coast somewhat rapidly for a certain distance until it gradually becomes sucked into the earth and disappears. By conducting the water into an artificial canal for a few yards, and by collecting the four points of supply into one, enough motive power is obtained to drive two mills. The stream, after being thus utilized, is allowed to follow its own course, and is lost among the rocks. . . . [It] has no visible outlet."

THE MINERAL CONCRETION OF THE TEAK TREE.[1]

AT the last meeting of the Nilgiri Natural History Society Mr. Lawson showed a specimen of a whitish mineral substance found in a teak tree growing in the Government Plantation at Nilambúr. This peculiar secretion is not altogether unknown to officers in the Forest Department, and its composition has on more than one occasion been investigated by chemists.

In 1870 the fact of calcareous masses occurring in timber was brought to the notice of the Asiatic Society of Bengal by Mr. R. V. Stoney, who stated (*vide* P.A.S.B., May 1870, p. 135) that many trees in Orissa had pieces of limestone or calcareous tufa

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[1] "Seismology: a Paper on Earthquakes in General; together with a New Theory of their Origin, developed by the Introduction of Submarine Telegraphy." By W. G. Forster, Manager and Electrician to the Eastern Telegraph Company, Zante. Dedicated, by Special Authority, to His Majesty George I., King of the Hellenes. Pp. 68. (London: Waterlow and Sons, 1887.)

[1] A Paper read by David Hooper at a meeting of the Nilgiri Natural History Society, Ootacamund, November 7, 1887.

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in their fissures, but principally Asan (*Terminalia tomentosa*, W. and A.), Swarm (*Zizyphus rugosa*, Lam.), Sissu (*Dalbergia sissu*, Roxb.), and Abnus (*Diospyros melanoxylon*, Roxb.).

In 1880, Mr. V. Ball, in making a geological survey in the Central Provinces, met with this concretion, and thus alludes to it in his "Jungle Life in India":—"Some white marks on the cut stumps of an Asan tree caught my eye, and these on examination proved to be sections or laminæ of calcareous matter which alternated with the ordinary rings of woody growth. The rocks about were gneisses and schists, and I could discover nothing in the soil to account for the peculiarity. In some cases irregularly shaped pieces seven inches long by two inches thick were met in the trunks at a height of about six feet from the ground. By the natives the lime is burnt and used for chewing with *pan*. On examination it was found there was no structure in these masses which would justify a conclusion that they had been formed by insects. Some included portions of decayed wood seemed to be cemented together by the lime."

Major-General Morgan, late Deputy Conservator of Forests, Madras, speaks of it in the following terms in his "Forestry of Southern India":—"It is a curious fact that in the Wynaad, though there is no free lime in the soil, yet Teak (*Tectona grandis*) and Blackwood (*Dalbergia latifolia*), if wounded near the ground, contrive to absorb large quantities of lime. It may be seen, incrusting the tree on the surface as far as four feet in height, from three inches to a foot in width, and two or three inches in thickness. The lime is so hard that it destroys circular saws, and the Carumburs use it for chewing with betel."

Abel, in 1854, thus described it: "The wood of teak, which grows in the South of India and other tropical countries, frequently exhibits cracks and cavities of considerable extent lined with a white crystalline deposit consisting chiefly of hydrocalcic orthophosphate, $CaHPO_4,H_2O$, with about 11·4 per cent. ammonio-magnesium phosphate" (Chem. Soc. Q.J. xv. 91.)

This white deposit in the wood of teak has also been examined by Thoms, who found it to consist of monocalcic orthophosphate, $CaHPO_4$ ("Landw. Versuchs. St." xxii. 68, xxiii. 413). More recently still Prof. Judd has found in teak a specimen of crystalline apatite, a well-known mineral containing a large proportion of calcium phosphate.

"The formation of this deposit indicates that the wood itself must contain a considerable quantity of phosphoric acid, and the analysis shows this is really the case, as the ash of teak wood is composed as follows:—

CaO	MgO	FeO	K_2O	Na_2O	SiO_2	SO_3	P_2O_5	CO_2	Cl
31·35	9·74	0·80	1·47	0·04	24·98	2·22	29·69	0·01	0·01

The percentages of carbon and hydrogen are higher than in most woods, and this together with the richness in calcium phosphate and silica may perhaps account for the great hardness of teak" (Watts' "Dict. Chemistry," 3rd Supp. p. 1894).

The sample from Nilambúr was in the form of a rounded flattened cake about ten inches in diameter and two or three inches in thickness; dirty white in colour, with a rough gritty surface. A sample was made for analysis by breaking off portions from different parts of the cake and reducing the whole to a fine powder. The powder examined under the microscope was mainly in an amorphous condition similar to prepared chalk, with a dark-coloured gummy matter, and a small quantity of crystalline quartz sand. The following is the composition:—

Calcium carbonate	70·05
Tricalcic orthophosphate	2·89
Quartz sand	9·76
Organic matter	14·30
Moisture	3·00
	100·00

The analysis shows that the principal compound is calcium carbonate, and the concretion approaches nearer the chalk or limestone formation than that of the apatite or phosphatic found by other investigators. An examination of deposits from other trees might show greater differences than these, but it seems enough has been done to prove that the calcium element forms the base.

The sand, probably blown up as dust and made to adhere by the organic matter, is a mechanical ingredient. The deposit contained no salts of sodium or calcium soluble in water, nor any ammoniacal compounds; this would stand to reason, as the heavy rain to which this district is subjected would scarcely leave anything soluble on the trees.

A sample of the soil from the Teak Plantations, the same as that in which the ipecacuanha is being cultivated, has also been examined. It is a light reddish brown sandy loam with quartz. In a dry state it contains 79 per cent. of silica and silicates, about 5 per cent. of organic matter, the same of iron oxide and alumina, and 0·217 per cent. lime as oxide.

The scanty amount of lime present in the soil, and the large amount found in the tree, show what an enormous quantity must have been taken up by the sap. I have shown elsewhere that a full-sized cinchona tree contains about ten ounces of lime (as slaked lime), not concentrated by abnormal development in one place, but distributed in all its parts. A teak tree from its size and ash contents would have a much larger supply than a cinchona, and yet, it seems, is able to excrete it in some abundance. In what manner this takes place is not easy to determine. The calcium enters the plant in a soluble form as sulphate. The calcium unites with oxalic and other acids and is precipitated, while the sulphuric acid parts with its sulphur to form organic compounds. A wound in the tree is liable to render these processes abnormal by causing the vegetable acids to ferment by exposure to the air and to yield carbonic acid as one of the products, and this meeting with the calcium in the ascending sap exuding from the wound might convert it into an insoluble calcium carbonate which would harden in the cavity of the tree and form the deposit.

THE NEW YORK AGRICULTURAL STATION.[1]

THE special report of the Director, Dr. E. Lewis Sturtevant, extends over the first fifty-seven of a volume of 480 pages, and within their limits are to be found the general conclusions arrived at during the past year. The remainder of the *brochure* consists of the detailed reports of the horticulturist, the botanist, and the chemist. After an analysis of the rainfall and temperature of 1887, which appear in general climatic conditions to have borne a great resemblance to what we ourselves experienced, the Director calls special attention to the importance of soil moisture, and surface cultivation as a means of conserving it. He shows the vast importance of checking evaporation from the surface by preserving a finely pulverized condition of the top soil. This he calls a "soil mulch," and states that "it protects the capillary outlets from surface exposure."

"The extent of the conservation of water through the prevention of evaporation by cultivation, as measured by the lysimeters in 1885 from May to September inclusive, with a rainfall of 14·42 inches, as between bare soil and cultivated soil, was about 1·4 inch, and as between cultivated land and sod-land about 2·5 inches. The rational direction, therefore, to the farmer for carrying out intercultural tillages must be to use an implement as a means to an end, *i.e.* the maintaining of a mulch of loose soil upon the field. . . . The intercultural tillage should be applied whenever the upper soil has regained, through the effect of rains, its connection with the lower soil, and the capillary tubes become extended to the surface. Following the same line of argument, the evil effects of weeds are attributed to their appropriation and transpiration of moisture from the soil rather than to their robbing the plant of food constituents. This conclusion will be brought home to anyone who notices the dry condition of the soil in near proximity to tree roots."

The remarks upon feeding cattle with a view to milk and to beef production are interesting, but the system of experimenting upon single animals is not to be commended. The conclusion forced upon the Director, that "individuality is sufficient to mask the influence of food," is patent to anyone, and should demonstrate the absolute need of carrying out any feeding experiments upon a large number of cattle simultaneously. Average results may then be expected upon which practice may be based.

The Director pours a flood of cold water upon the system of plot experiments in the field. Under the head of "Conclusions" he says:—"These field trials indicate the utter unreliability of field experiments, and should convince the public of the lack of certainty which attends all general conclusions gained by this process. I trust the time may arrive when this plat work, instead of being forced upon experiment stations, will be condemned." Certainly

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[1] Sixth Annual Report of the Board of Control of the New York Agricultural Experiment Station (Geneva, Ontario Co.) for the year 1887.

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